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Inventors: Vivek Agarwal; Victor Prince Sundarsingh; Serge Bontemps and Alain Calmels
 POWER CONVERTER METHOD AND APPARATUS HAVING HIGH INPUT POWER
 FACTOR AND LOW HARMONIC DISTORTION
 Serial No. 10/689,863 Filed: October 20, 2003
 Our Docket No. 1138-102

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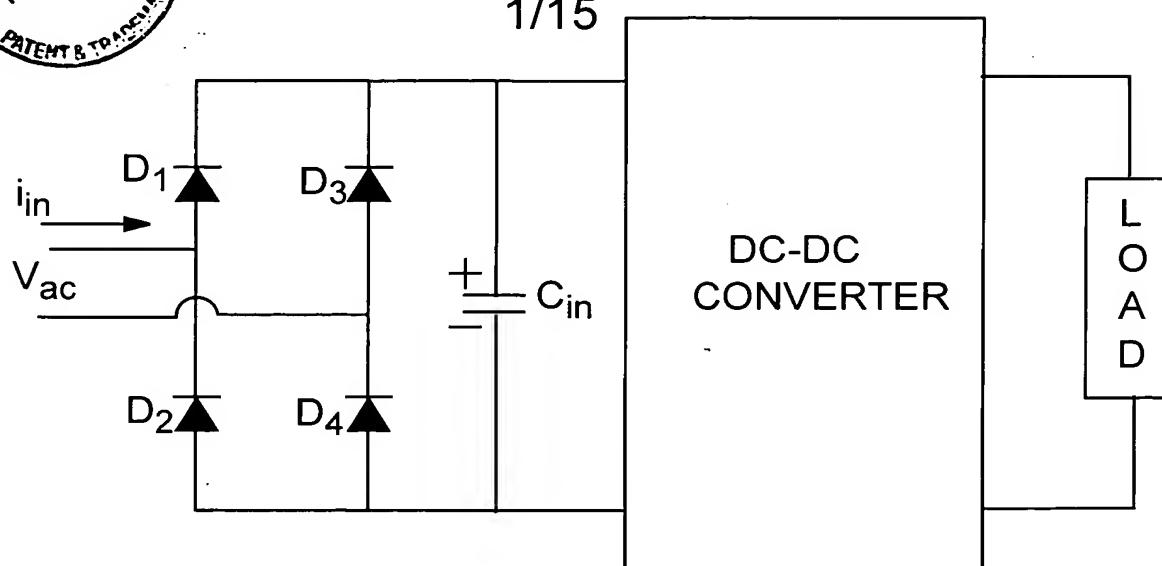


FIG. 1A (PRIOR ART)

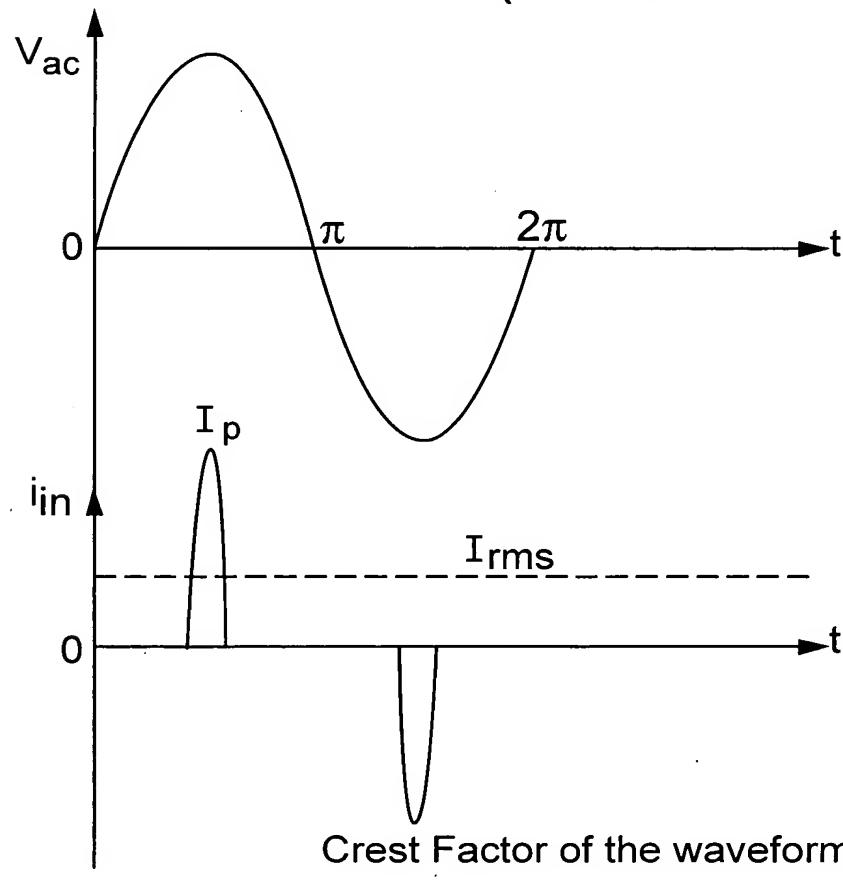


FIG. 1B (PRIOR ART)

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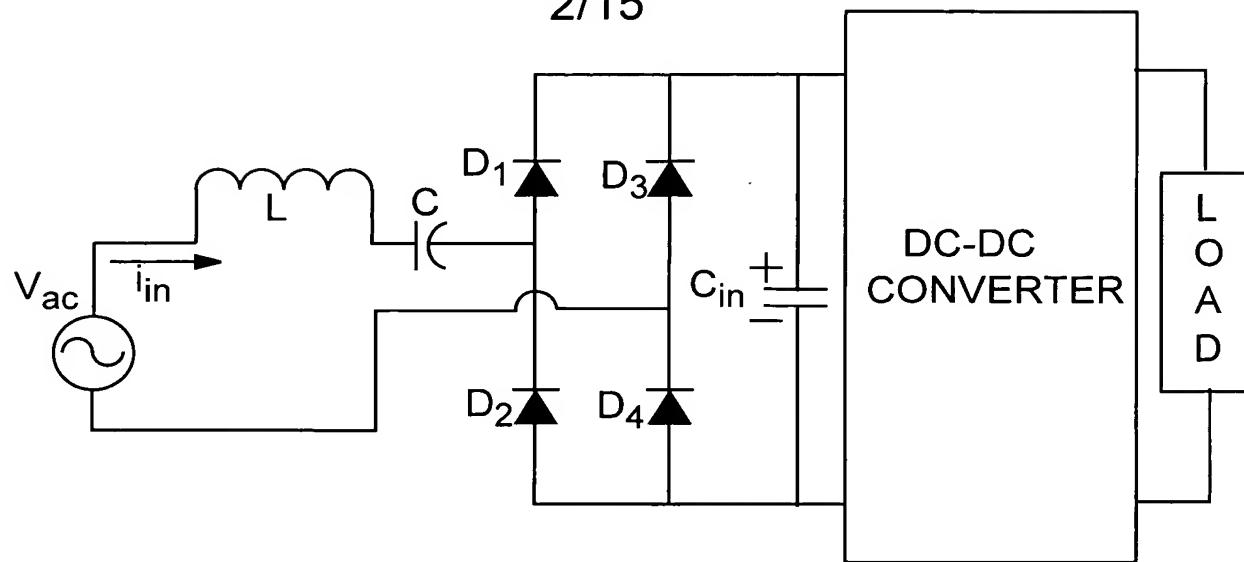


FIG. 2 (PRIOR ART)

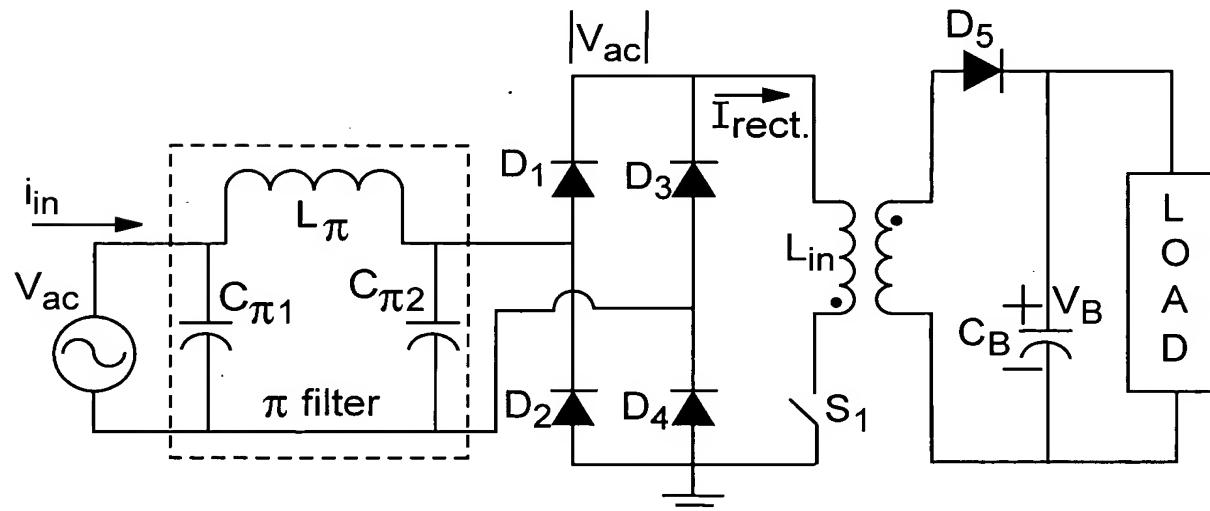


FIG. 3 (PRIOR ART)

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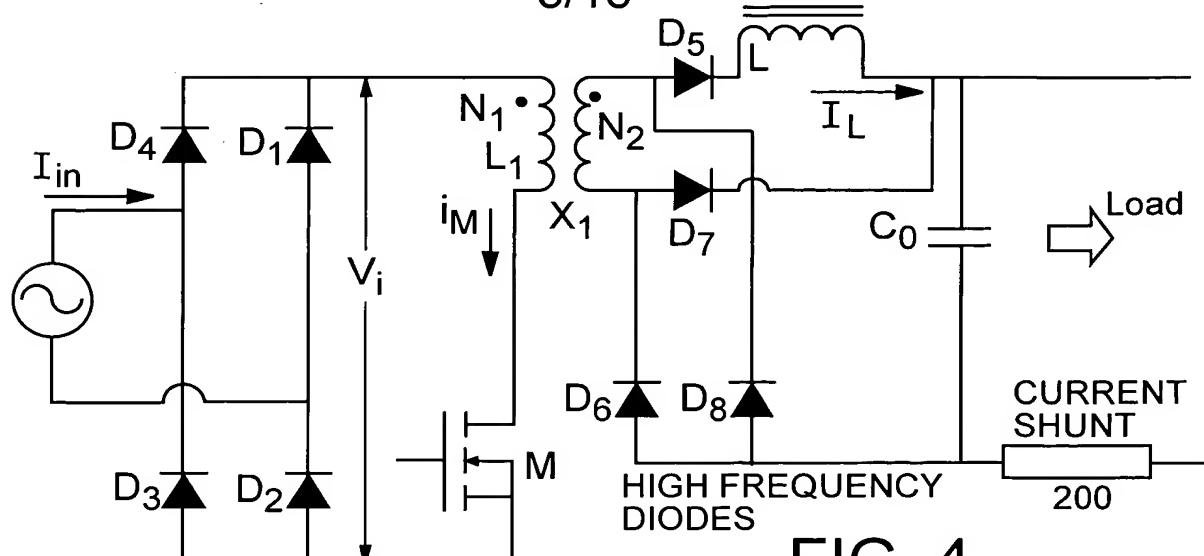


FIG. 4

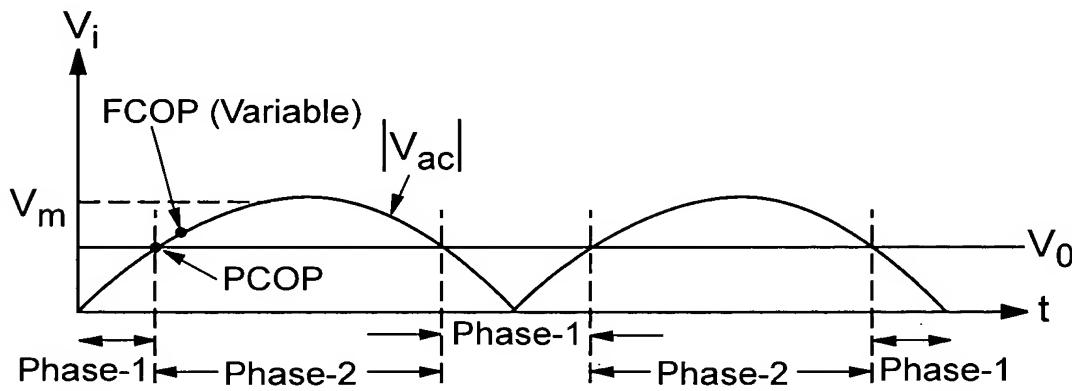


FIG. 5

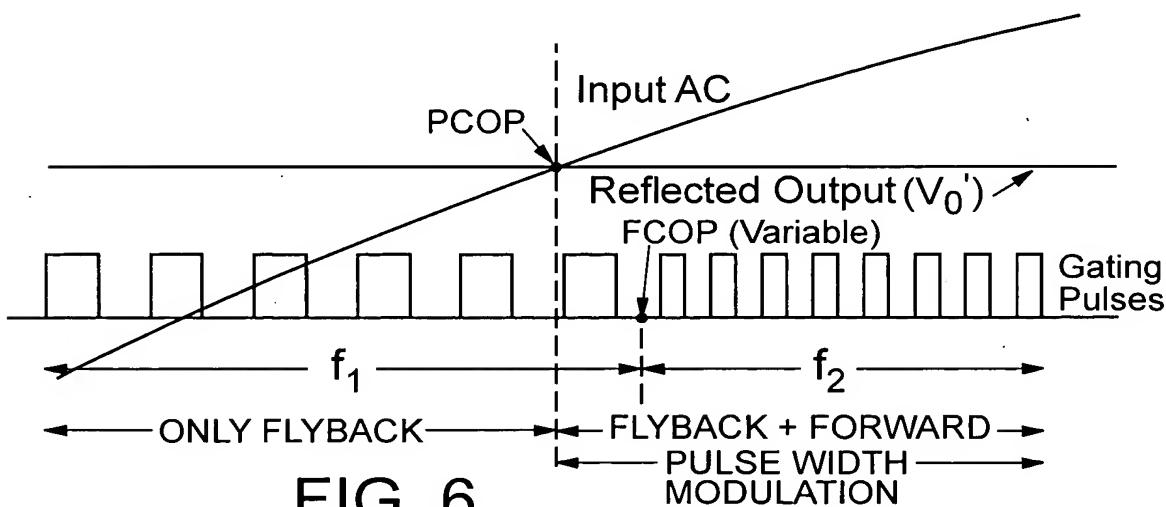


FIG. 6

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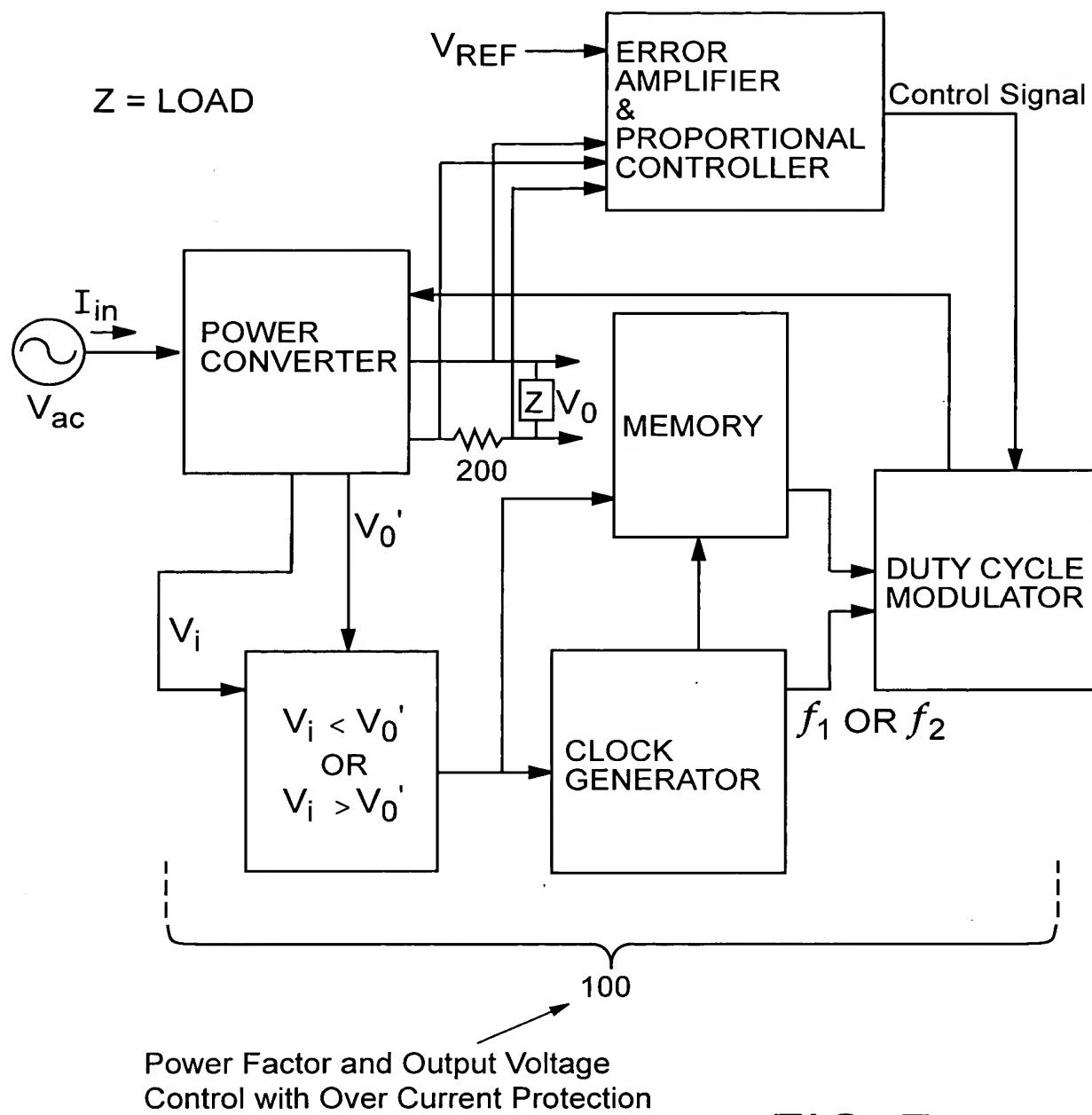


FIG. 7

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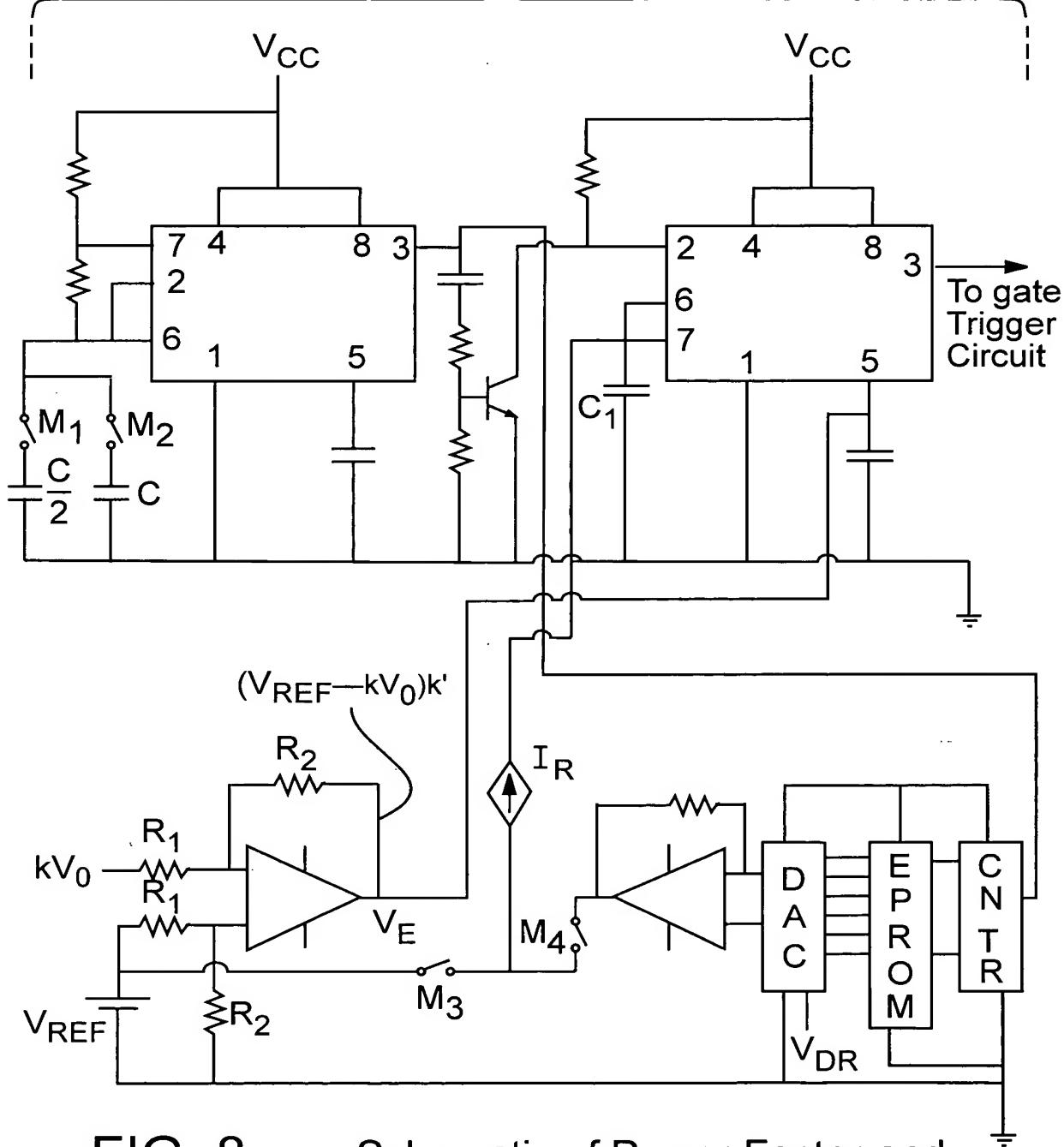
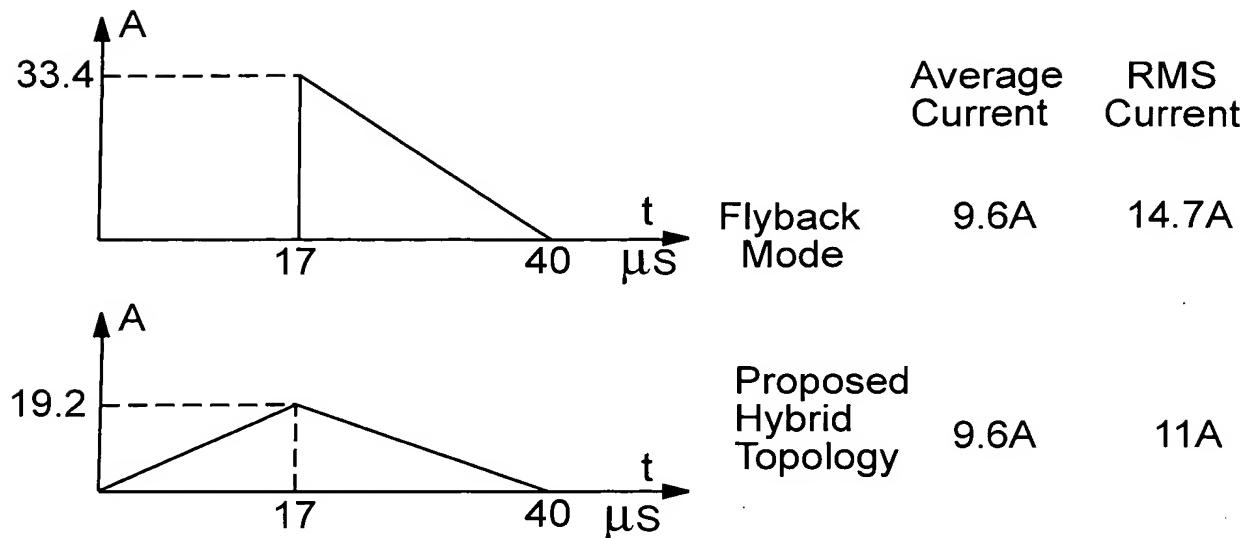


FIG. 8 Schematic of Power Factor and Output Voltage control

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Secondary current waveforms

Hybrid technology helps significantly to reduce both peak and RMS currents

FIG. 9 The secondary current waveforms for a flyback converter and hybrid technology

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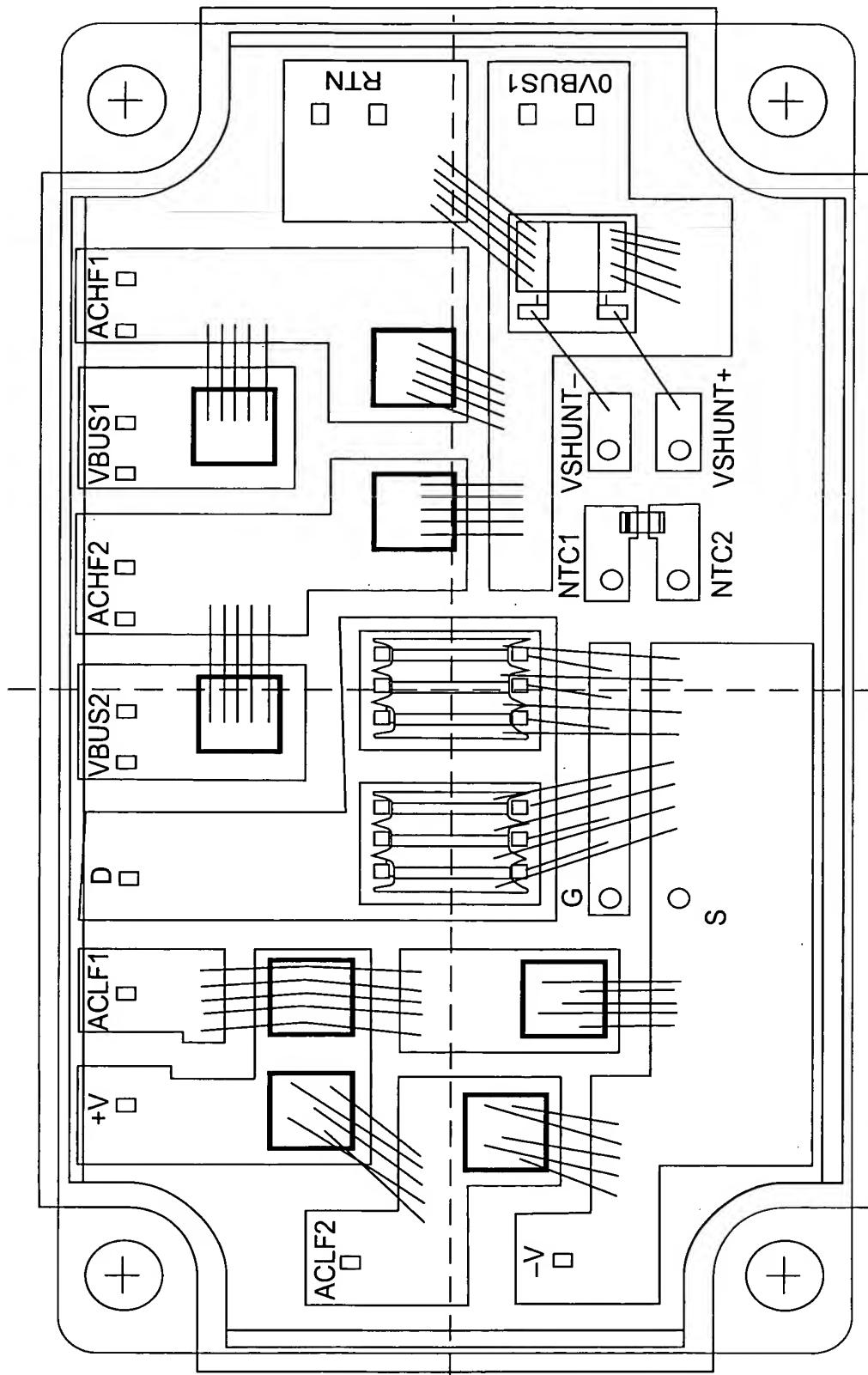


FIG. 10A POWER MODULE – LAYOUT
SMART CONVERTER MODULE – POWER STAGE

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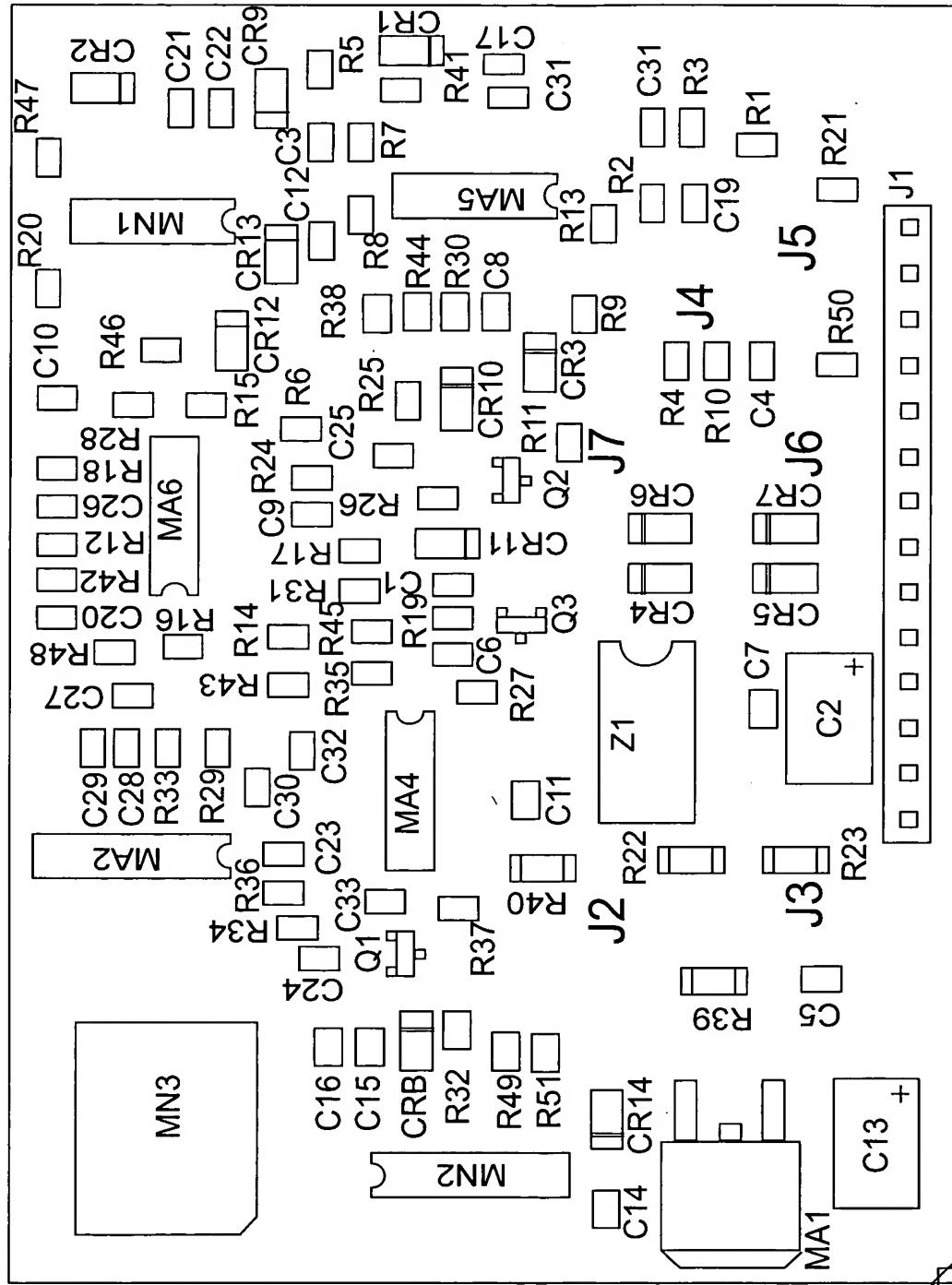
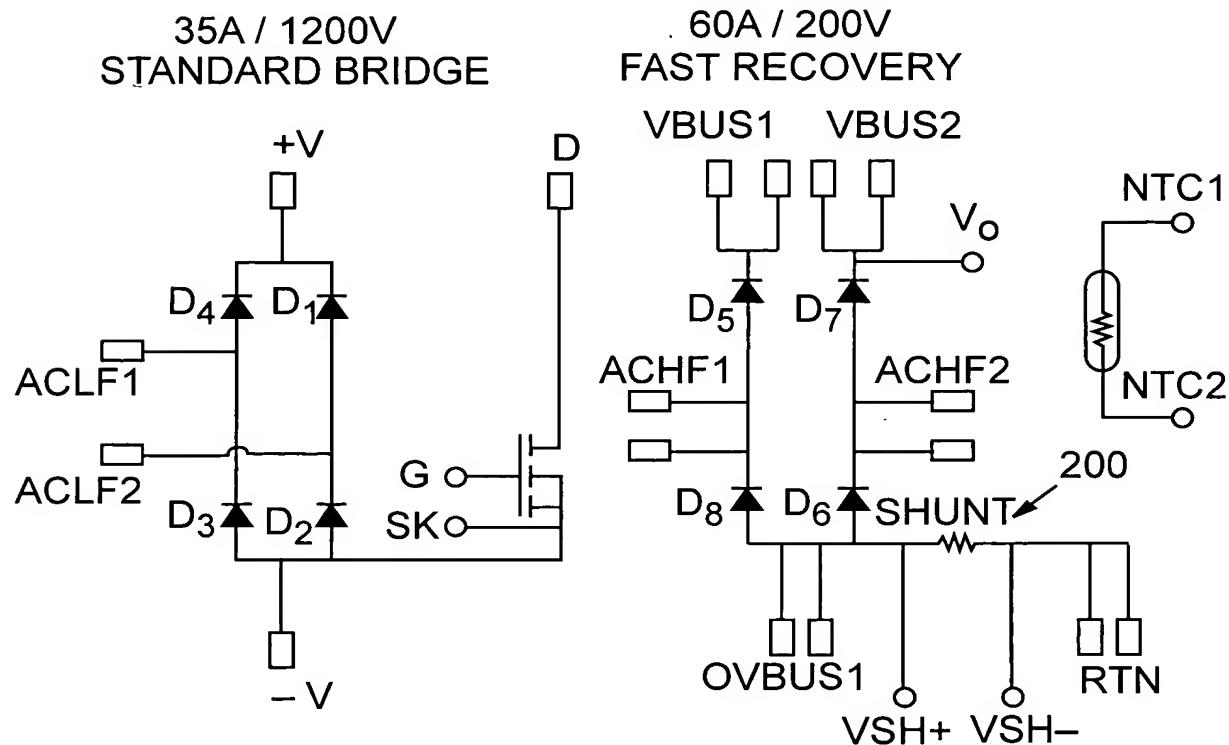


FIG. 10B POWER MODULE – LAYOUT
SMART CONVERTER MODULE – CONTROL STAGE

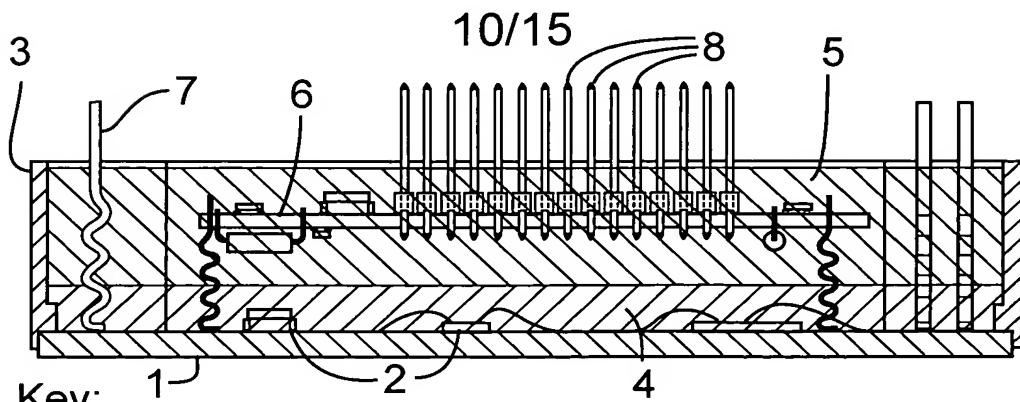
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—○ CONNECTION BETWEEN POWER SUBSTRATE AND PCB
 (INTERNAL CONNECTIONS)

—□ POWER CONNECTION AVAILABLE TO USER

FIG. 11



Key:

- (1) Module base plate (IMS substrate)
- (2) Silicon chips and other power components, soldered to the substrate: upper connections to chips via ultrasonically bonded aluminum wires.
- (3) Moulded outer wall
- (4) Silicone gel conformal coating over substrate assembly
- (5) Resin top layer to fill cavity
- (6) Internal PCB, with all necessary control and protection functions: hybrid SMD/chip construction.
- (7) 1 x 1.5 solderable power connectors
- (8) Small signal connector. These connectors are available to the user for control circuit inputs (e.g. power supply points, DC output voltage feedback signal etc.)

FIG. 12 Cross Section of Module

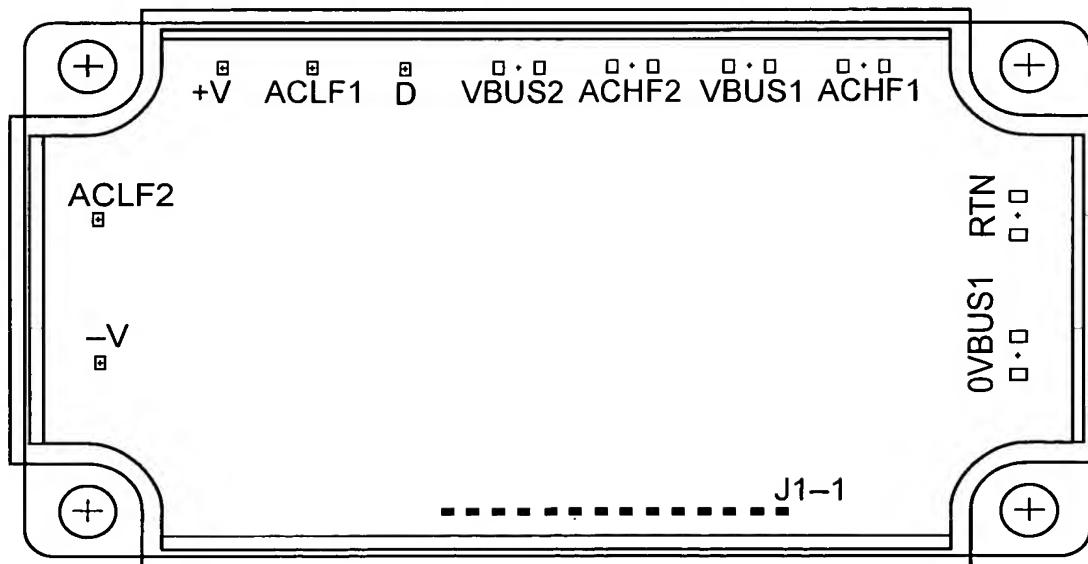


FIG. 13

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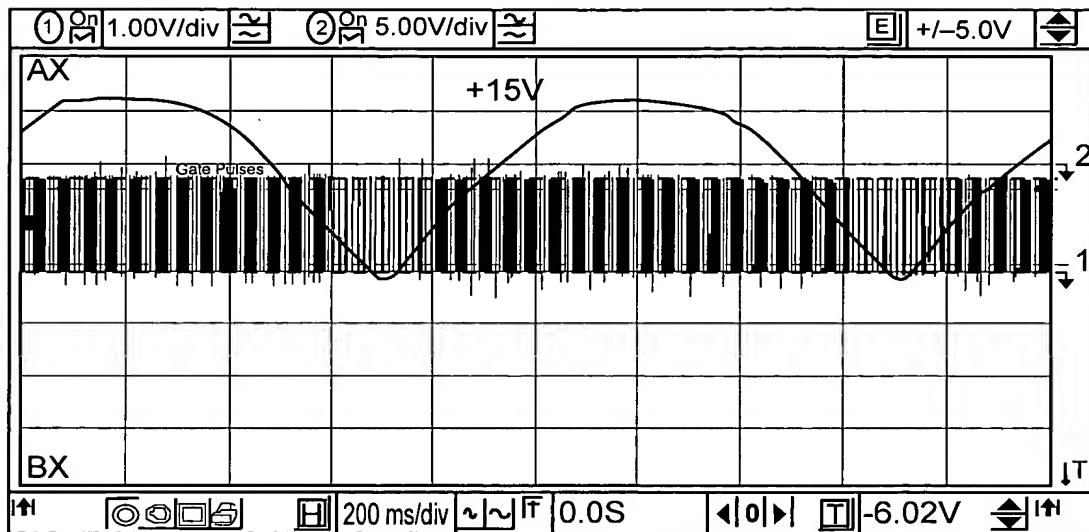


FIG. 14

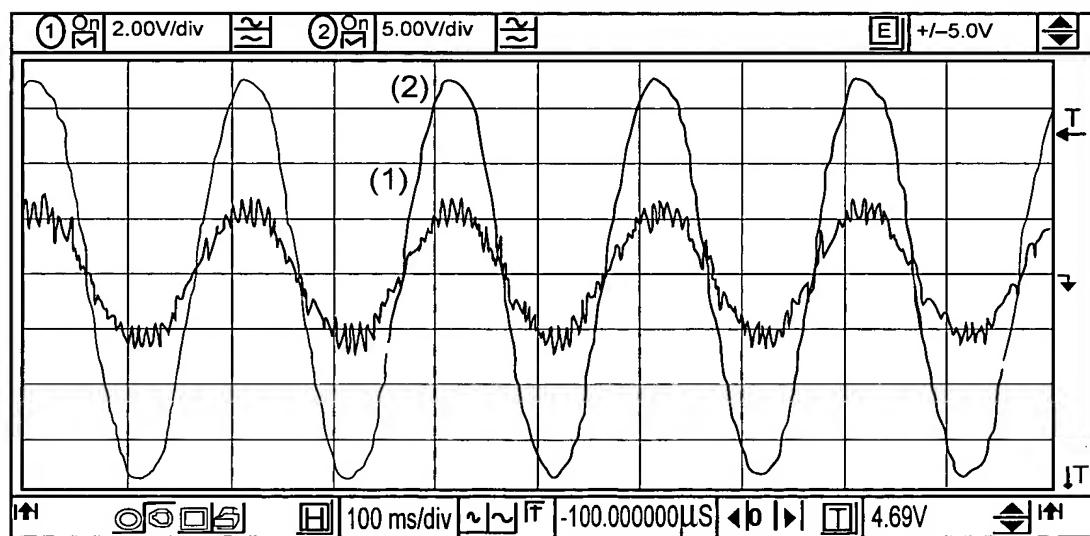


FIG. 15

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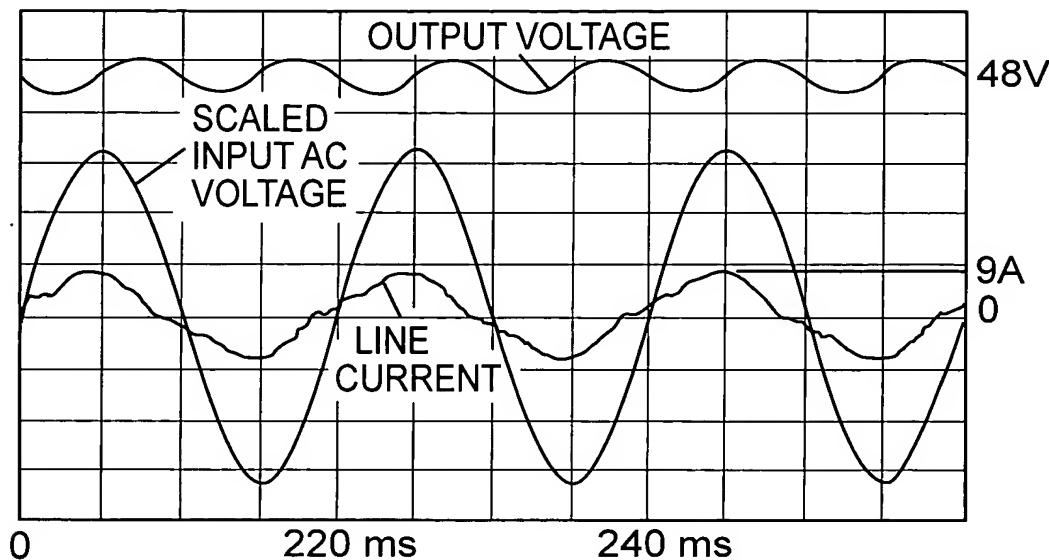


FIG. 16

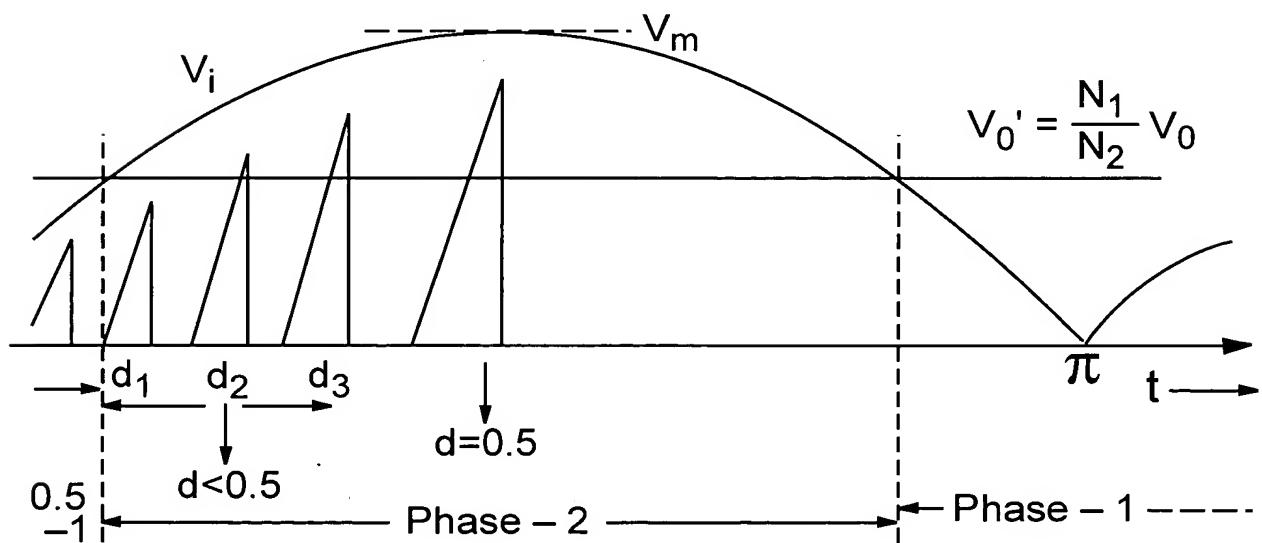


FIG. 17 Primary Side Current Waveforms
 Corresponding to the Maximum Load Condition
 $d_1 < d_2 < d_3 < \dots$

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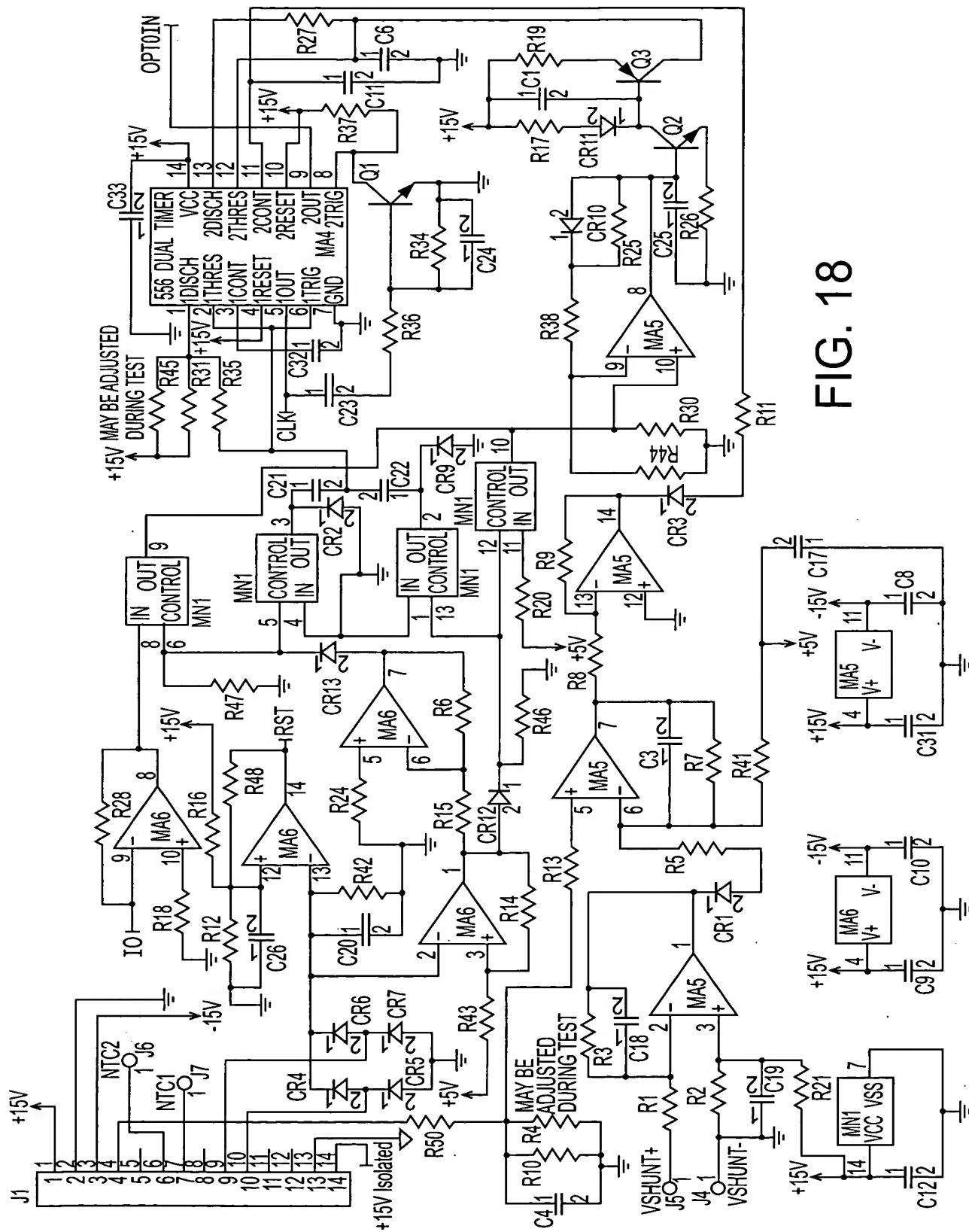


FIG. 18

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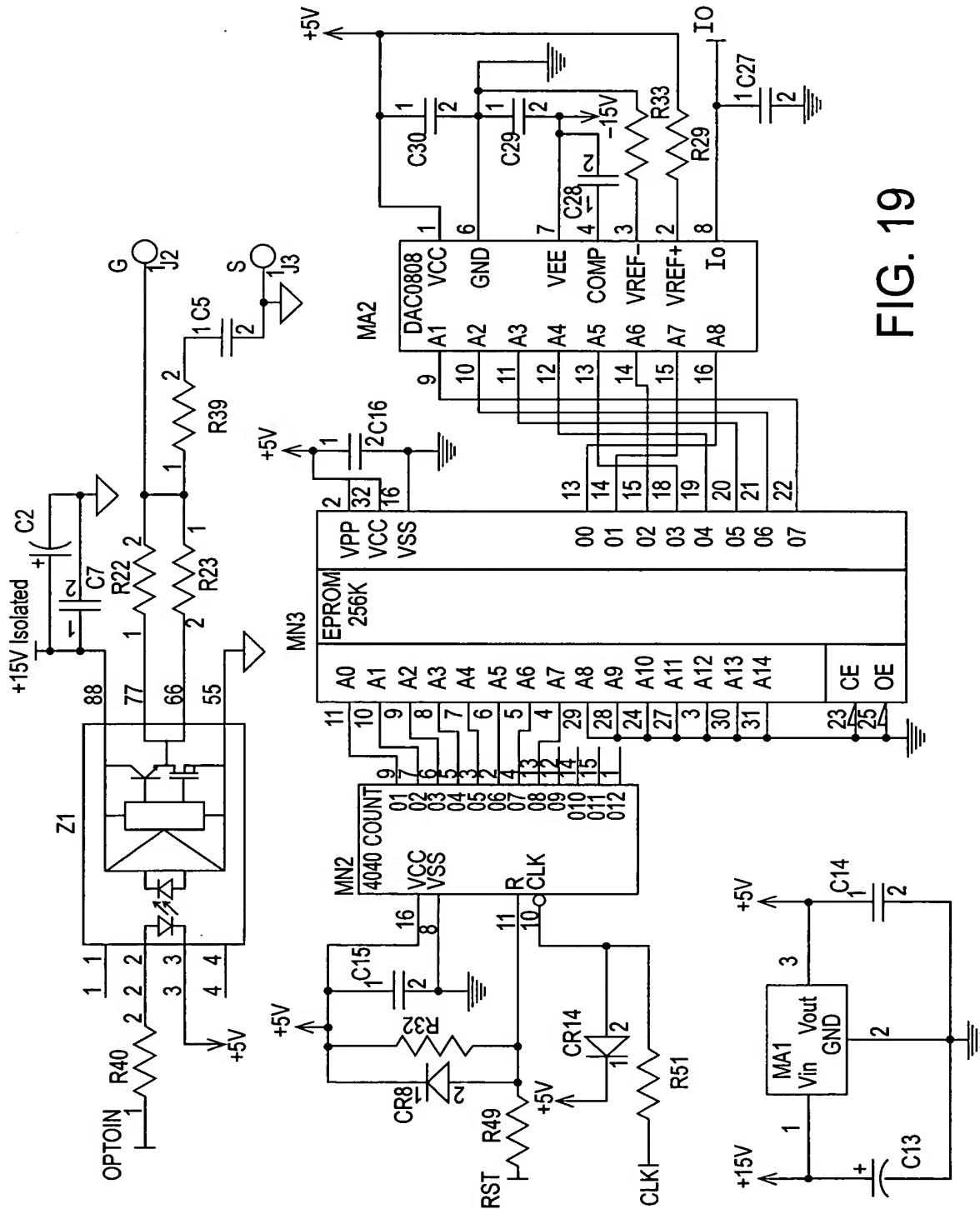


FIG. 19

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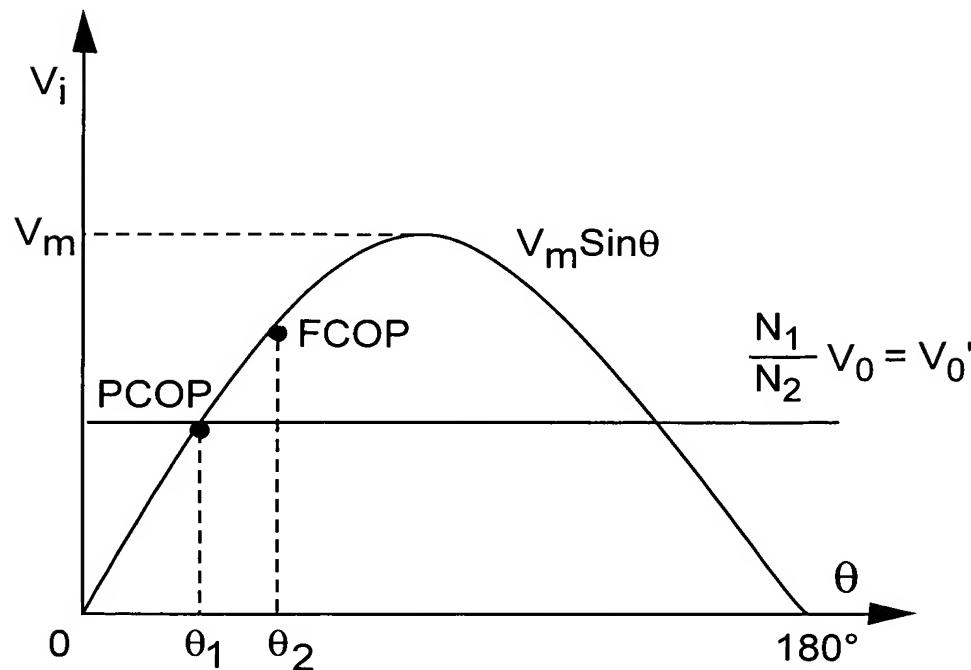


FIG. 20 Diagram showing relative positions of PCOP and FCOP